ROCKS AND MINERALS ON THE EARTHS CHANGING SURFACE

Grade level: Second
Standards: 2.1.2 Construct an explanation about changes in Earth's surface that happen quickly or slowly. Emphasize the contrast between fast and slow changes. Examples of fast changes could include volcanic eruptions, earthquakes, or landslides. Examples of slow changes could include the erosion of mountains or the shaping of canyons. (ESS1.C)
Duration: three 30-35 minute lessons
Adaptions: see suggested adaptations for ways to use this lesson plan for 1st through 4th grades.

LESSON 1: FAST & SLOW - 35 MINUTES

Learning Objectives:
I can understand that some changes happen quickly and some changes happen slowly.
I can understand that the change I see today also happened in Earth's history.
I can understand that I can see the evidence of the Earth's changes all around me.

INSTRUCTORS CONTENT GUIDE

Uniformity is the uniting principle of modern geological science. The term describes how modern, observable processes that change the surface of the earth happened the same way in the past.

Changes to the earths surfaces are happening constantly. Usually we can only observe changes that are happening quickly.

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There are a number of specific processes that contribute to the creation and shaping of the earths surfaces.

- **Weathering**: breaking down rocks, earth, and landscapes
- **Erosion**: the processes that move materials around
- **Tectonic activity**: the breaking up of the Earth's surface along tectonic faults, including volcanism.
- **Cementation:** when materials dissolve & glue together
- **Compression**: pressure, typically from overlaying rock layers, compresses material.

These processes can occur through various natural phenomenon. some of these happen quickly and some happen very slowly over millions of years.

Quickly	Slowly
• volcanoes	• wind erosion
• landslide	• sedimentation & cementation
• floods	• river (fluvial) erosion
• earthquakes	• tectonic uplift

These smaller, slower changes can still be observed, but typically only on a very small scale. For example, if you sat at the bank of a river, you might be able to see very small pieces of earth being pulled down stream.

LESSON PLAN

Direct instruction - 15 minutes

Use the content guide above to instruct students on different processes of weathering and erosion and how they change the earths surface.

consider using some of the following images and videos to illustrate the processes.

- Volcano Erupting: https://youtu.be/CgpNqrR318U?si=y98Fs_HBJTjCaKYd
- Erosion, Depositing Sediment, and Cementation: https://youtu.be/04a_32NuYqs?si=SSC-euml1_EVkv7J
- Landslides & Erosion: https://youtu.be/erM7d0vUWz0?si=FAMYd4ogMFV8pkIp
- River Erosion, Meander & Oxbow: https://youtu.be/nGJXxAZPm8M?si=kTmm0zM2ZUrjBhVT

- Tectonic Uplift Animation: https://youtu.be/loFxYSHxTf0?si=Xs5cSjFAUXnYrHPd
- Erosion timelapse, wind & water: https://youtu.be/k2AQnpcW_HY?si=fTO4PZK7rVPDv9pQ
- The Grand Canyon: sedimentary rock (cementation) and river erosion https://www.flickr.com/photos/grand_canyon_nps/albums/72157626136162880/with/5477434484
- Active volcanoes and lava flows: https://www.nps.gov/media/photo/gallery.htm?pg=23663&id=01FE2CD0-F4A8-4F32-9EA1-8D1A7090C12D

Student Discussion - 5 minutes

Direct students to small groups or pairs and discuss the following questions.

- "Have you ever witnessed one of these events? What was it like?"
- "If you haven't, what do you think it would be like? Would it be scary? Would it help you understand the world better?"
- "Have you ever gone somewhere where you've been able to see the evidence of one of these events?"

Adaptation: consider turning these discussion questions into a grade appropriate writing assignment.

Student Activity - 10 minutes

Provide students with a half sheet of paper and coloring materials. Instruct students, in pairs or small groups, to individually choose one of the following options: **Wind Erosion, River Erosion, Volcanoes, Landslides, or Tectonic uplift**. Instruct students to draw a picture of whichever process they chose without telling their partner or group.

Adaptation: consider grouping students who might have difficulties coloring in pairs to work together as a team on their picture. You could also simply use coloring sheets.

This section of the activity could also be turned into a grade appropriate creative writing assignment.

As students finish, they can challenge their partner or group to try and guess which option they chose. If time allows, they can share their pictures with the class.

LESSON 2: LET'S TALK ABOUT ROCKS! - 35 MINUTES

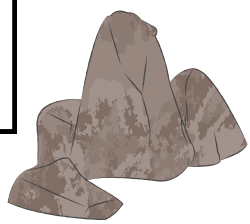
Learning Objectives:
I can identify the difference between a rock and a mineral.
I can determine if a rock is sedimentary, metamorphic, or igneous.
I know what the rock cycle is and the processes that make up the rock cycle.

INSTRUCTORS CONTENT GUIDE

What is the difference between a mineral and a rock? Use the table below to explore the characteristics of rocks and minerals and talk about how they are the same and how they are different.



MINERALS	ROCKS
-Occur naturally -Inorganic (are not made from living things) -Solid (cannot be a liquid or a gas) -Have a definite chemical composition -Have an internal structure.	-Occur naturally -Made of 2 or more minerals -Are either: -Igneous -Sedimentary or -Metamorphic



Teacher's Note: The museum has a "Rock Kit" that you can check out to show your class some examples for each type of rock. Visit https://museum.bcutah.gov/education/ for more information.

There are three types of rocks: igneous, sedimentary, and metamorphic. Rocks can change from one type of rock to another through physical and chemical processes.

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When melted minerals are under the Earth's crust they are called **Magma**.
When they are above the Earth's crust they are called **Lava**.

Igneous Rocks are made from minerals melted deep inside the Earth.
When these melted minerals cool they form Igneous rocks.

There are two types of Igneous Rocks: **Intrusive** and **Extrusive**.
Intrusive Igneous Rocks are formed when magma cools and solidifies slowly beneath the Earth's surface. Example: Granite
Extrusive Igneous Rocks are formed when magma erupts onto the Earth's surface as lava and cools quickly. Example: Obsidian

Sedimentary Rocks are formed from the accumulation and cementation of sediments, which can be minerals or organic particles. Fossils are usually found in sedimentary rock layers.

There are three types of Sedimentary Rocks: **Clastic, Chemical,** and **Organic.**

Clastic Sedimentary Rocks are made up of fragments of other rocks, minerals, or organisms. Example: Sandstone.
Chemical Sedimentary Rocks are formed by the precipitation of minerals from solution. Example: Limestone
Organic Sedimentary Rocks are formed from the remains of once-living organisms. Example: Coal

Metamorphic Rocks are formed when existing rocks are changed by heat, pressure, and/or chemical reactions within the Earth's crust.

There are two types of Metamorphic Rocks: **Foliated** and **Non-foliated.**
Foliated: have a layered or banded appearance. Example: Mica.
Non-foliated: do not have a distinct layering. Example: Marble.

All of these rocks are formed through the same processes discussed in the previous lesson. To review:

- Weathering and erosion
- Tectonic and volcanic activity (extrusions, cooling and melting, heat and pressure)
- Compression & cementation

LESSON PLAN

Review - 5 minutes
in a class wide discussion, ask students if they can remember some of the content from the previous lesson. Ask if they can remember some of the processes that were discussed, and weather or not they are fast and slow
Examples:

- "Volcanoes exploding! which is fast"
- "Erosion from wind or a river, which is slow"

Adaptation: If students are struggling with the content, consider reviewing more in depth by reviewing specific terms and re-watching some of the videos and asking them to identify the processes shown.

Direct Instruction - 10 minutes
Use the content above to instruct students on different kinds of rock, how to identify them, and how they form. Emphasize that most kinds of rock take a very long time to form, but certain kinds of igneous or sedimentary rock can form quickly.

Adaption: content may be used for older or younger grades. limit or expand content based on what is appropriate for your students.

If available, use the the rock kit available from the Brigham City Museum to help students have tactile examples. A guide to the rock kit is available at the end of this lesson guide.

Activity - 15 minutes
Provide students with both sheets from the "sort and review" activity. Students can cut out the cards on page one and paste them onto the grid on page two.

Adaptation: if students have difficulty reading the descriptions, examples, or definitions on the cards, consider reading through them together as a class and explaining any confusing terms before students do the activity independently.

Wrap up & clean up - **5 minutes**
While the glue is still wet, go through the correct answers for the placement on the grid together.

ROCK TYPES

Sort & Review

Activity Instructions:

1. Cut out the boxes on page 1
2. Stick them underneath the correct rock type in the table on this page

Sedimentary	Metamorphic	Igneous

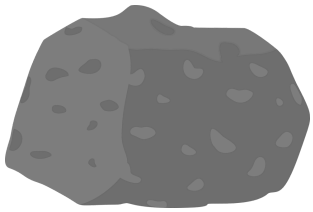
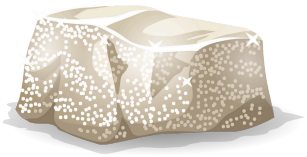
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ROCK TYPES

Sort & Review

Activity Instructions:

1. Cut out the boxes on this page
2. Stick them underneath the correct rock type in the table on page 2

	Rocks that are changed from pressure or heat.	made of crystals. strong, shiny and hard.
Rocks made from sediments that have built up over a long time	Examples: Chalk, sandstone, shale and limestone.	
Examples: Granite, basalt, gabbro and obsidian.	Shiny, hard, layered, and twisted	Rocks formed when magma cools and becomes solid.
Dusty, layered, and grainy.		Examples: Marble, slate, quartzite and anthracite.

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LESSON 3: ROCKS IN MY BACKYARD - 30 MINUTES

Learning Objectives:
I can tell by looking at a rock how it was formed.
I understand that the different rocks around me contribute to the different landscapes I see all around me.

LESSON PLAN

Review - 5 minutes
in a class wide discussion, ask students if they can remember some of the content from the previous lesson. Ask if they can remember the different kinds of rock and how to identify them
Examples:

- "Metamorphic rock is shiny and sometimes twisted."
- "Sedimentary rock has layers," or "Sedimentary rock has little particles."
- "Igneous rock has bubbles." or "Igneous rock has crystals."

Direct Instruction - 15 minutes
Use the content provided in previous lessons and the images provided below to discuss how these different rocks show up in the landscape all around you. Depending on the resources in your location, you may also be able to look out a window or step outside to look at some different kinds of rock.

- **Metamorphic**: both Willard Peak & Mount Olympus are made mostly of quartzite, a metamorphic rock. You can see the layers and twists in the peaks.
    - See the bright quartzite rock 'rainbow' https://upload.wikimedia.org/wikipedia/commons/thumb/f/f1/Utah_%2815597470683%29.jpg/500px-Utah_%2815597470683%29.jpg
    - The semi-vertical west slabs of Mount Olympus https://upload.wikimedia.org/wikipedia/commons/thumb/d/d1/Mount_Olympus_Utah.jpg/1280px-Mount_Olympus_Utah.jpg
  - The oldest rock forming Grass Creek Complex, partially in in Box Elder County, is schist, a kind of metamorphic rock. https://geology.utah.gov/wp-content/uploads/Green-Creek-Schistresize-495x400c.jpg
  - The Farmington Canyon Complex, which is in the Wasatch Mountains of Northern Utah, is full of gneiss, another kind of metamorphic rock! https://geology.utah.gov/wp-content/uploads/FarmingtonGneiss.jpg

- **Igneous:** Various kinds of volcanic formations can be viewed around Utah, but some of them are not obvious to the casual observer. For example, what is now the Bear River Migratory Bird Refuge originated as volcanic mud flats. To see more obvious examples, you have to travel a bit further
    - When driving towards Idaho falls, you pass through a small section of a larger lava field: https://www.flickr.com/photos/blmidaho/35262528932/
    - Ridge from volcanic uplift in Millard county: https://geology.utah.gov/wp-content/uploads/PressureRidge-180x180c.jpg
    - Inferno cone - large cinder mound at Craters of the Moon National Monument and Preserve : https://www.nps.gov/npgallery/GetAsset/2c507883-e284-b04a-0901-b9b8f8a475b6/proxy/hires?
- **Sedimentary:** like igneous rock, small evidences of sedimentary rock formation are all around, but the most visible and famous examples tend to be in southern Utah.
    - Conglomerate rock in Maple Canyon (Sanpete county) https://geology.utah.gov/wp-content/uploads/10-3-2013-frontcover-ClarkD-MapleCanyon_2_0470-1030x773.jpg
    - Sedimentary rock at Capitol Reef National park, with badlands erosion formation also visible https://www.nps.gov/npgallery/GetAsset/68d30f1d-155d-451f-6700-292371e6bf9f/proxy/hires?

If available, use the the rock kit from the Brigham City Museum to help students have tactile examples while reviewing the pictures. A guide to the rock kit is available at the end of this lesson guide.

Discussion - 5 minutes

Have students discuss the following questions in pairs or small groups:

- Can you think of places in the state of Utah where you might find examples of each rock type?
- What rock types do you think you can identify near your home?

Adaptation: consider extending the discussion or practicing writing skills by turning the discussion into a grade appropriate writing assignment

Homework (show and tell) - 5 minutes

Instruct students to go home and find a rock. This could be in their yard or somewhere appropriate in their neighborhood. Make sure they write down or remember where exactly they got it from. Students should bring the rock to class the next day & be prepared to share what kind of rock it is. They can share in small groups or with the whole class.

Adaptation: for older grades or advanced students, also ask them how that rock might have ended up where they found it. What can they infer about the landscape

For more information,
visit us at
24 North 300 West
Brigham City, UT 84302
Use the basement entrance on the west side of the building.

Or check out our website for more educational content:
museum.bcutah.gov

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